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THE RENT OF MINERAL LANDS

SUMMARY

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I

SINCE the days of Ricardo most economists have contented themselves with a discussion of the doctrine of rent only as it applies to agricultural land or urban land. If mineral or forest land has been mentioned, it has usually been dismissed with a brief paragraph or two based largely on generalizations and not on facts. So unsatisfactory has the treatment been that today — after a hundred and twenty-five years of discussion of the rent theory — there is no generally accepted analysis of the return on mines. Many modern economists and writers do not mention the subject; those who do, are not agreed in their statement of the theory. One group, represented by Professor Taussig, maintains that mine royalties are closely analogous to the rent of agricultural

land. Another group, including chiefly the mineral owners of England, maintains that they are not rent at all but a consideration for the mineral removed from the deposit. Still another group, represented by Professor Marshall, maintains that mine royalties are both rent and compensation for the mineral.

Ricardo did not hesitate to extend his doctrine of rent to all classes of land, yet he understood the modifications that must be made before it could be applied to mineral lands. His two chapters on rent in the *Principles* should be studied together. In Chapter II he stated that "the compensation given for the mine or quarry is paid for the value of the coal or stone which can be removed from them and has no connection with the original and indestructible powers."¹ Yet in Chapter III he said that "there are mines of various qualities, affording very different results, with equal quantities of labor. . . . The return for capital from the poorest mine paying no rent, would regulate the rent of all the other productive mines. This mine is supposed to yield the usual profits of stock. All that the other mines produce more than this, will necessarily be paid to the owners for rent."²

The apparent inconsistency may be easily explained. In Chapter III, which is entitled "The Rent of Mines," Ricardo was concerned only with the return on mines due to their original and indestructible qualities. He was assuming (tho he failed to make clear the assumption) that the compensation paid for the mineral removed, mentioned in Chapter II, had already been deducted. Ricardo undoubtedly believed that mine royalties had a dual character — that they were partly a payment for minerals removed and partly a differen-

1. Ricardo, *Principles of Political Economy* (Gonner edition), p. 45.

2. *Ibid.*, p. 62.

tial return due to the superior location or the greater fertility of particular mines.

Professor Taussig is of the opinion that the rent of mines, particularly in old countries, is closely analogous to the rent of agricultural land and follows the same economic laws. He doubts whether any surplus exists in new countries or in the mining of those minerals for which the risks of prospecting and exploitation are so great that the large profits on a few mines no more than offset the losses on the others. Mining for gold or copper is particularly risky. He remarks: "Where royalties are paid in well explored countries on minerals whose qualities and value are reasonably well known, they are simply rent. Such seems to be the case with royalties on English coal mines."³ But Professor Taussig does not agree with Ricardo's contention that a part of the royalty is compensation for the mineral removed. "The fact that a store is physically limited does not enable its owner to secure a price. Sand and clay are thus limited; but the available quantity is so abundant that a clay pit or sand deposit is worth nothing unless it has an advantage of situation. It may be doubted whether any payment at all, royalty or what not, can be secured by the owner of the poorest mine, assuming he has done nothing to develop it. Deposits of this sort are at the margin of utilization and at the margin there is no surplus of any sort. . . . Rent proper shows the same sort of development on mines as on other natural agents."⁴

Professor Marshall takes the same position as did Ricardo. He believes that mine royalties are both compensation for the mineral removed and economic rent. "A royalty is not a rent, tho often so called. For, except when mines, quarries, etc., are practically inexhaustible,

3. F. W. Taussig, *Principles of Economics*, vol. ii, p. 96.

4. *Ibid.*

the excess of their income over their direct outgoings has to be regarded, in part at least, as the price got by the sale of stored up goods — stored up by nature indeed, but now treated as private property.”⁵

I agree with Professor Taussig that there is probably no surplus from mines in new lands. The large profits no more than offset the risks and dangers of exploration and the many losses that occur. It is a generally accepted belief that the total expended in the search for gold far exceeds the product from gold mining. But this sort of situation is not peculiar to mines. The same statement is probably equally true of agricultural land in a newly settled country. During the last century millions of acres of land were given away by the United States government in Nebraska, Kansas, and other middle western and western states, or the land was sold at a few cents an acre. During the lifetime of the original settlers that land sold for \$50 an acre or even more. But how much of that increase in value was surplus or unearned increment and how much of it was necessary to compensate the homesteaders for the risks and dangers of pioneering? How much of it was necessary to offset the losses in regions where the increase in land values did not occur? It is estimated that in one period of drought a quarter of a million of people were driven out of western Kansas alone.

The Ricardian rule of rent cannot be applied without qualifications to either agricultural or mineral land in a new country. In its unqualified form it fits conditions in a settled country such as England and in formulating the doctrine Ricardo had the farm lands of England in mind. After the simple statement of the rule is understood it may then be extended to other lands where the land question is more complicated than in England. To

5. Marshall, *Principles of Economics*, p. 438.

get a similar statement of the theory as applied to mineral land we will do well to first examine the nature of mine royalties in a long-established country such as England and in a long-established mineral industry such as coal mining. In a country that has been well explored and prospected by geologists little uncertainty remains regarding the extent and nature of the mineral deposits — particularly those of greatest economic importance, namely coal and iron. Even in the United States, a comparatively new country, the government has about completed the mapping and valuation of the coal lands of the public domain. In order to avoid unnecessary complications in making a typical statement of the theory I shall confine my discussion largely to the coal mines of England.

I am inclined to accept Ricardo's analysis of mine royalties. They are made up of two elements governed by entirely different economic laws. First there is a part representing "the diminution in value of the mine regarded as a source of wealth in the future which is caused by taking the ton out of nature's storehouse," as Professor Marshall expresses it. It is not rent. It is a consideration for the sale outright of the mineral removed just as tho the owner of a large farm had sold a cottage site. It is principal, not income. Then there is another part of the payment that arises because of the superiority of a given mine over the marginal mine. It is income. It is rent in the strict economic sense and is governed by the Ricardian doctrine.

That mine royalties are of the nature of economic rent is recognized by Professor Taussig, but he does not believe that any payment is made for the mineral removed. Mine royalties in his view are analogous to the rent of agricultural land. But obviously there is a difference. The owner of a farm expects his land to be

returned at the expiration of the lease in as good condition as when first rented. There should be no deterioration in fertility. Careful farming may even improve the land and a wise farmer will prefer to allow his land to be worked, under best farming methods, rent free rather than allow it to lie idle. The situation is not the same for mineral land. Its yield is drawn from a store that cannot be replenished. The coal removed from the seam cannot be replaced either for this generation or for a later one. Every ton extracted decreases the stored up treasure by that much and the deposit is certainly less valuable than before the coal was removed. The mine that has been worked cannot be returned to the owner unchanged at the end of the lease.

It is true that there are coal deposits so situated or with seams lying at such great depths that no one will pay a royalty on them. Perhaps they can be worked profitably if no royalty is paid, and the owner may work them himself, but he will not permit anyone else to work them without some compensation. He gains nothing; he loses an asset that may bring in an income for himself or his heirs with a change in market conditions. Not only would there be the exhaustion of a store that might some day prove valuable, but the opening of a mine does not improve what the Scotch call the amenities of the neighborhood. The owner of the surface may be compensated for the damage done to that surface through subsidence, but there can be no compensation for the marring of the beauty of the locality with an ugly mine mouth, a black coal tippie, or a dump heap. As a witness before the British Coal Industries Commission aptly expressed it: "A colliery chimney is not an attraction to an estate; it may be as tall as Nelson's Monument, but it behaves somewhat differently."⁶

Not only may the surface be damaged by subsidence but the construction of a network of underground workings may result in such a lowering of the water table that the land will yield much less in grass or grain. The owner of the coal land will surely demand payment for the coal removed if he permits the deposit to be worked. That payment has been called the minimum royalty, but I prefer to call it the marginal royalty since the term minimum royalty is also applied to the fixed rent per acre that is sometimes paid on coal land. The mine commanding only the marginal royalty is the marginal mine.

The dual character of mine royalties is recognized in practice by mine operators. The late Dr. Rossiter W. Raymond, a distinguished American mining engineer, then secretary of the American Institute of Mining Engineers, summarized the American position as follows in his testimony before the British Royal Commission on Mining Royalties appointed in 1889: "With us the royalty always settles itself according to special advantages. The lowest royalty is the royalty that must be paid, or else the landowner would not care to let the mine be worked. On top of that, you have all those higher royalties coming in to represent special natural advantages." ⁷ Before a more recent British coal commission, Mr. T. H. Bailey, a mining engineer of Birmingham, stated that "strictly speaking, royalties are partly rent or income, and partly capitalization of assets." ⁸

True, a group of writers made up largely of British mineral land owners and their representatives maintains that a royalty is a payment for the mineral re-

7. Third Report, Royal Commission on Mining Royalties, British Sessional Papers, 1890-91, vol. xli, p. 10.

8. British Coal Industries Commission Report (1919), vol. ii, p. 691.

moved and nothing more. They do not agree with Ricardo, or Marshall, or Taussig in the application of the Ricardian rent doctrine. They fail to take into consideration the "special natural advantages" mentioned by Dr. Raymond. They state, for example, that "in all cases the colliery proprietor (if not himself the owner of the coal) pays a royalty, i. e., a purchase price for unsevered coal,"⁹ or that "a royalty is payment of purchase of coal,"¹ or again that "this royalty, or sum, is often referred to as rent, but is in fact a payment out and out for the coal worked which disappears from the mine."² Such a position is difficult to defend. If mine royalties are solely a payment for the mineral obtained from the mines how can the differences in the royalties paid on mines in the same neighborhood — even situated side by side — producing coal of exactly the same quality be accounted for? or the fact that mines in different parts of the country command different royalties? Only by the Ricardian doctrine can these differences be explained.

II

Mine royalties may differ because of a difference in the quality of the coal. In the United States royalties as high as 50 cents per ton are paid on anthracite coal and 10 cents or less on some grades of bituminous. But this difference does not necessarily represent any surplus. It may be due to a difference in the marginal royalty. The two grades of coal have different values. They bring different prices in the market. The owner of the anthracite deposit will demand a higher marginal

9. British Coal Industries Commission Report (1919), vol. i, p. 300; testimony of Henry Louis, Professor of Mining, University of Durham.

1. Ibid.

2. Ibid., p. 312, testimony of R. F. Pawsey, secretary of Mineral Owners Association of Great Britain.

royalty than the owner of the bituminous deposit since a more valuable product is being taken from his land. A true surplus arises only when a given amount of labor and capital is able to obtain a greater tonnage of coal in one mine than in the other. Accordingly in making comparisons I shall assume that the coal or mineral obtained from the mines compared is of the same quality and that the mines are in direct competition.

Mine royalties may differ because leases have been made at different times. In a lease made in a boom year a higher royalty may be exacted than in a lease made in a year of general industrial depression. I therefore assume that the leases on the mines compared have been made at the same time and under identical conditions.

Mine royalties may differ because of what Ricardo called the original and indestructible powers of the land — what Professor Ely calls the inseparable conditions of the land. These powers or conditions are both extrinsic and intrinsic. The extrinsic powers include transportation and market; the intrinsic, thickness of seam, depth, angle of seam, faulting, nature of roof, and the like. “The workability of any coal will ultimately be determined by two offsetting factors — (1) its character and heat-giving quality, whence comes its value, and (2) its accessibility, quantity, thickness, depth, value, and other conditions that affect the cost of its extraction.”³

One of the indestructible powers of all land, mineral or agricultural, is location. As with agricultural land, the location of a mine near a market will cause it to yield a surplus over a mine less favorably located and subject to high transportation charges. Mines located

3. Bulletin 537, “The Classification of Public Lands,” U. S. Geological Survey (1913), p. 67.

near industrial or shipping centers command higher royalties than those more distantly located. In the islands north of Alaska there are large deposits of coal but they are so far removed from market that not only do they pay no royalties but they are still untouched by the hand of man. In West Virginia within 200 miles of Fairmont there are large areas of coal land, owned by the Baltimore and Ohio Railroad, situated so far from a railroad that they are still undeveloped. The United States Geological Survey in its classification and valuation of government coal lands places on lands more than 15 miles from a completed railroad a value one-half of the amount which would be fixed if they were less than 15 miles from a railroad.⁴

Two mines situated side by side and producing the same grade of coal may command different royalties because of differences in intrinsic factors. Their seams may lie at different depths or angles. The seams of one may be thicker or contain less slate than the seams of the other, or they may be less faulted or broken. The material of the roof of one mine may be stronger making necessary less timbering. To describe all these points of superiority that one mine may have over another a term ordinarily applied to agricultural land may be used: one mine is more *fertile* than the other. Because of its greater fertility a smaller quantity of labor and capital is required to extract a ton of coal. The owner of the more fertile mine can demand a higher royalty than the owner of the less fertile mine just as the owner of the more fertile farm demands a higher rent than the owner of the less fertile farm. In Kentucky the usual royalty on coal from seams 3 to 4 feet thick is 8 cents per ton, from seams 4 to 5 feet thick, 10 cents, and from seams 5

4. Bulletin 424, U. S. Geological Survey (1910), p. 41.

to 6 feet thick, 12 cents.⁵ The difference in royalty is a surplus and is economic rent. Before the British Commission on Mine Royalties already cited Sir Lowthian Bell, President of the Cleveland Mine Owners' Association, stated that: "The royalty dues paid in Cleveland for ironstone are about 6 pence per ton. In Lincolnshire or Northamptonshire they are sometimes double this sum because instead of expensive shafts and machinery being required, the mineral lies near the surface with a covering of greater or less thickness of sand or rock."⁶

TABLE I⁷

Thickness of bed in feet	Average cost		Approximate combination cost	Value by inversion
	Anthracite	Bituminous		
1	2	3	4	5
10	1.00	1.00	1.00	1.00
9	1.01	1.03	1.02	.97
8	1.045	1.075	1.05	.95
7	1.10	1.126	1.10	.91
6	1.18	1.20	1.20	.83
5	1.35	1.30	1.33	.75
4	1.65	1.45-1.55	1.50	.66
3	2.13	2.00	2.00	.50
2	3.36	3.00	3.00	.33

Table I is an adaptation of a table published by the United States Geological Survey showing the relation of thickness to the value of a bed of coal. It is used by the Survey in determining the value of coal beds under government land. In the first column is given the thickness of the seams in feet, ranging from 2 feet to 10 feet. A seam with a thickness of 10 feet is taken as a standard

5. Bulletin 424, U. S. Geological Survey (1910), p. 10.

6. First Report, Royal Commission on Mining Royalties, British Sessional Papers, 1890, vol. xxxvi, p. 149.

7. Adapted from table, U. S. Geological Survey, Bulletin 537 (1913), p. 84.

and in columns 2 and 3 the cost of working such a seam is unity or 1.00. The costs of working the thinner seams is expressed in terms of the cost of the thicker seam. A seam of anthracite 2 feet thick costs 3.36 times as much to work as a seam 10 feet thick. Column 4 is an approximate combination of the average cost of working anthracite and bituminous coal. Column 5 shows the relative value of the seams and is obtained by inverting the cost of extraction, or in other words by dividing 1.00 by the figures in column 4. A seam 5 feet thick has a value 75 per cent of the value of a seam 10 feet thick, and a seam 2 feet thick is valued at only 33 per cent of the value of the 10-foot seam.

The Ricardian theory of rent involves the concept of no-rent land, or land that produces only enough to pay the costs of production. Similarly there must be a no-rent mine or a marginal mine. Economists have been misled in their efforts to find that no-rent mine. They have perceived that all mines, even the poorest, yield some royalty, but they have not understood that the royalty on the poorest mine is not economic rent but compensation for the mineral removed. The mines paying such royalty are the no-rent mines. They are the marginal mines.

England's position as a manufacturing and commercial nation may be said to rest upon a foundation of coal and iron, and the English have always shown a keen interest in their deposits of those two important minerals, especially since Jevons in his book on *The Coal Question* pointed out that the deposits were not inexhaustible. Some thirty years ago a royal commission was appointed to investigate the effect of royalties upon the mining industry. In their voluminous report are many bits of evidence that prove the correctness of the present analysis of mine royalties. In more recent years

other commissions have been appointed to study various coal problems, notably the Coal Industries Commission of 1919. Tho the later commissions have given some attention to the nature of mine royalties they have brought to light very little information not already published by the earlier commission.

The investigation of the Royalty Commission of 1889-93 was not limited to the English mining industry, it included a study of the mining laws of the leading mining countries of the world. One of the laws reported on was the important French mining law of 1810 which provides, among other things, for a proportional royalty to be paid by the mine operators to the owners of the surface. Table II shows the usual royalties paid at the time of the investigation (1890) in the basin of the Loire.

TABLE II.⁸ — MINE ROYALTIES IN BASIN OF LOIRE (1890)

Depth of seam		Thickness of seam			
		A	B	C	D
		2 meters and over	1 to 2 meters	$\frac{1}{2}$ to 1 meter	Less than $\frac{1}{2}$ meter
I. In pits	50 meters deep	1/6 of y'd	1/9 of y'd	1/12 of y'd	1/24 of y'd
II. " "	50 to 100 m. deep	1/8 "	1/12 "	1/16 "	1/32 "
III. " "	100 " 150 " "	1/10 "	1/15 "	1/20 "	1/40 "
IV. " "	150 " 200 " "	1/12 "	1/18 "	1/24 "	1/48 "
V. " "	200 " 250 " "	1/14 "	1/21 "	1/28 "	1/56 "
VI. " "	250 " 300 " "	1/16 "	1/24 "	1/32 "	1/64 "
VII. " "	beyond 300 " "	1/20 "	1/30 "	1/40 "	1/80 "

The French law recognizes that mines differ in fertility and establishes a differential based upon both thickness and depth of seam. The marginal mine is the mine with the deepest and thinnest seams that can be worked at the market price for coal. If the demand for coal is such

8. Adapted from Final Report, Royal Commission on Mining Royalties, British Sessional Papers, 1893, vol. xli, p. 64.

that mines more than 275 meters deep or with seams less than $\frac{3}{4}$ meters thick cannot be worked profitably, the mines at those limits are the marginal mines and the marginal royalty is $\frac{1}{3\frac{1}{2}}$ of the yield as shown by Group VI, column C of the table. A mine 75 meters deep and with seams $2\frac{1}{2}$ meters thick would command a royalty of $\frac{1}{8}$ of the yield. The marginal royalty would be $\frac{1}{3\frac{1}{2}}$ of the yield, the remainder — $\frac{1}{8}$ minus $\frac{1}{3\frac{1}{2}}$ or $\frac{3}{3\frac{1}{2}}$ of the yield — would be economic rent. The French law of 1810 may not express the true differential between the various grades of mines but it does recognize that such a differential exists and that even the poorest mine worked pays some royalty. The marginal royalty, provided for under the French law, must not be confused with payment for damage to the surface which is covered by an entirely different provision.

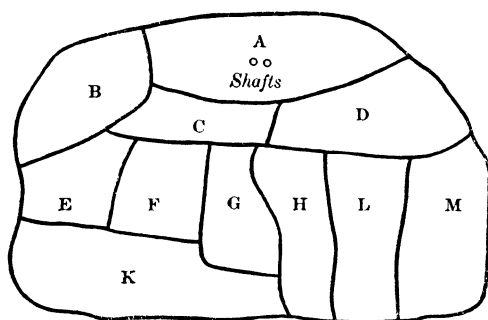


FIGURE 1. Area represented = 2000-3000 acres.

Figure 1 is a diagram of the various small holdings in a coal field attached to a large colliery in Durham, England. Each of the plots has a different owner; all are leased to the operator of the colliery. The shafts for the field are located in plot A and all the coal leaves the ground there. Wayleave charges and easement rents must be paid to the owners of the plots through which coal is carried on its way to the shaft and a shaft rent

must also be paid to the owner of A. In other words the plots at a distance from A are at a disadvantage and their costs of production are greater than those of A. Plot A should therefore command the highest royalty, the differential being economic rent. Table III shows the royalties, easement rents, etc., paid by the various holdings in 1889.

TABLE III.⁹ — ROYALTIES, EASEMENT RENTS, ETC., PAID IN 1889 IN COAL FIELD SHOWN IN FIGURE 1

Royalties reference letter	Royalty tonnage rent on coals worked	Other royalty proprietors charging easement rents	Easement ¹ rents per ton	Total of mine and easement rent per ton	Date of leases
	pence		pence	pence	
B.	4.22	— A	1.85	6.07	1849
C.	4.25	— A	1.85	6.10	1856
D.	5.33	HCA	2.55	7.88	1864
E.	4.29	CA	1.94	6.23	1853
F.	3.61	GHCA	3.17	6.78	1843
G.	3.79	HCA	2.55	6.34	1880
H.	3.75	CA	1.95	5.70	1873
K.	3.82	GHCA	2.86	6.68	1865
L.	4.00	DHCA	3.04	7.04	1886
M.	4.00	DHCA	3.04	7.04	1878
Av. exclusive of A	4.11		2.48	6.59	
A.	5.00			5.00	1847

It will be noted that the highest royalty per ton is paid on holding D — not on holding A — tho D must also pay easement charges to the owners of H, C, and A. This apparent contradiction of the rent theory may be accounted for by the fact that the leases for A and D were not made under identical conditions but in dif-

9. First Report, Royal Commission on Mining Royalties, British Sessional Papers, 1890, vol. xxxvi, pp. 32, 146.

1. An easement rent is a sum paid for moving coal across another's land.

ferent years — A in 1847 and D in 1864. It will also be noted in the fifth column of the table that after the easement and other charges have been added to the royalties the total charge per ton for all holdings is practically the same. Inconsistencies are probably due to the making of the leases in different years.

In the diagram Mine K appears to have the least favored situation as it is located farthest from A and coal must cross G, H, C, and A to reach the shaft. The table shows that K receives a royalty lower than the royalty of any other holding except F, G, and H. The mine galleries have apparently been so constructed that coal from F and G must follow almost the same route as coal from K and must pay the same charges. Neither the diagram nor the table gives any explanation for the low royalty of plot H. Perhaps it can be accounted for by the panic of 1873, the date of the lease, or perhaps in this holding the operator has secured most of the economic rent for himself. Holdings A, B, C, D, E, L, and M, bring to their owners a surplus above the returns on the marginal mine, or economic rent.

Figure 2 is a diagram of another colliery with holdings in Durham. Holding A, in which the shaft for the field is sunk has the most advantageous position. Holdings C and E are the marginal holdings for the field and pay the lowest royalties. As shown in Table IV the marginal royalty for the field is 3 pence. Holdings A, B, and D yield an economic rent.

TABLE IV.²—ROYALTIES PAID ON HOLDINGS IN DURHAM COAL FIELDS

Plot A — 6	pence per ton
“ B — 4	“ “ “
“ C — 3	“ “ “
“ D — 4	“ “ “
“ E — 3.3	“ “ “

2. Second Report, Royal Commission on Mining Royalties, British Sessional Papers, 1890-91, vol. xli. Appendix XX.

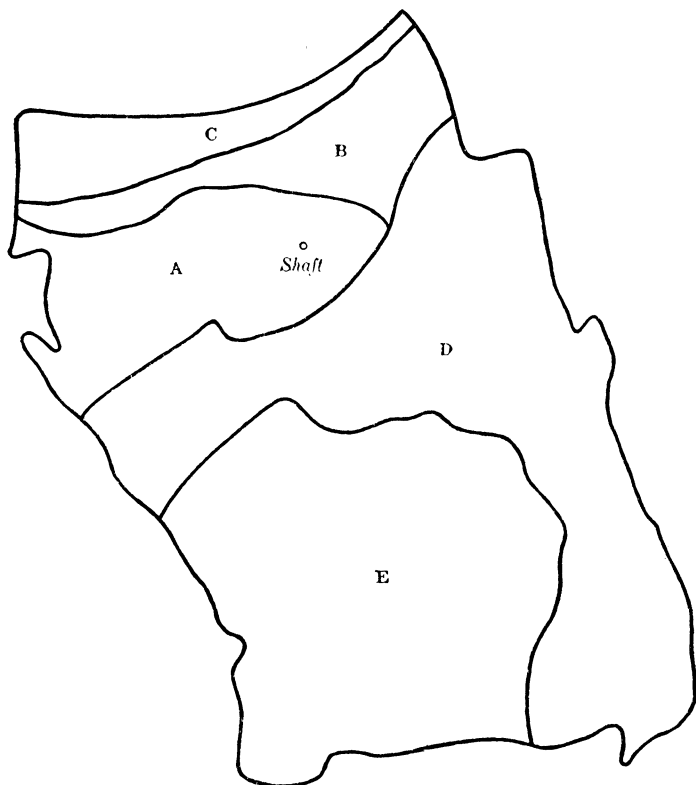


FIGURE 2. Scale: 32 chains per inch (1 chain = 66 feet).

Diagram showing various holdings comprised in the coal field attached to a large colliery in the county of Durham, England.³

It is not so easy to secure examples to show the practice in the United States where the lease system is not so firmly established as in England with its estates retained in one family for generations. In this country it is estimated that 65 per cent of the bituminous coal comes from land owned by the mine operator. The remaining 35 per cent comes from leased land.⁴ In the

3. Second Report, Royal Commission on Mining Royalties, British Sessional Papers, 1890-91, vol. xli. Appendix XX.

4. Thirteenth Census Report (1909), Mines and Quarries, p. 210.

production of anthracite coal the percentage is even greater. Previous to the enactment of the commodity clause in the Interstate Commerce Act and its enforcement, almost 80 per cent of the anthracite was mined by the railroads or by companies controlled by the railroads; and it was estimated that the railroads and affiliated companies controlled either by ownership or by contract over 96 per cent of the unmined anthracite.⁵ It is true that the railroads leased the coal lands to operating companies, but the royalties were a nominal charge and bore little relation to the true value and accessibility of the coal. The railroads controlled the operating companies and received their profits. They also received the freight money for hauling the coal to market. The Girard Estate, administered by the city of Philadelphia, owns large areas of anthracite coal lands that are leased to operating companies. Unfortunately for our purpose the royalties are not a fixed payment per ton but are a percentage of the selling price of the coal at the breaker — or in other words they are based on a sliding scale. However at least one of the intrinsic factors is evident in the determination of that scale. In some leases 18 per cent of the selling price is charged on coal from seams over 4 feet in thickness, and 16 per cent on seams under 4 feet. In other leases the percentages are fixed at 20 and 16 per cent or at 28 and 23 per cent.⁶

The quotations on pages 298, 299, and 300 from publications of the United States Geological Survey show also that in the United States, where any attempt is made to determine the royalties accurately, the same principles hold as those which govern royalties in the United Kingdom. They are partly compensation for the mineral

5. Eliot Jones, *The Anthracite Coal Combination*, pp. 108, 109.

6. U. S. Senate, *Hearings of Committee on Manufactures*, 65th Congress, 2d Session (1919), vol. iii, p. 1717.

removed and partly surplus or economic rent arising through superiority of some mines over others.

The analysis of mine royalties may perhaps be made clearer by a graphic presentation. Figure 3 is an attempt at such a presentation.

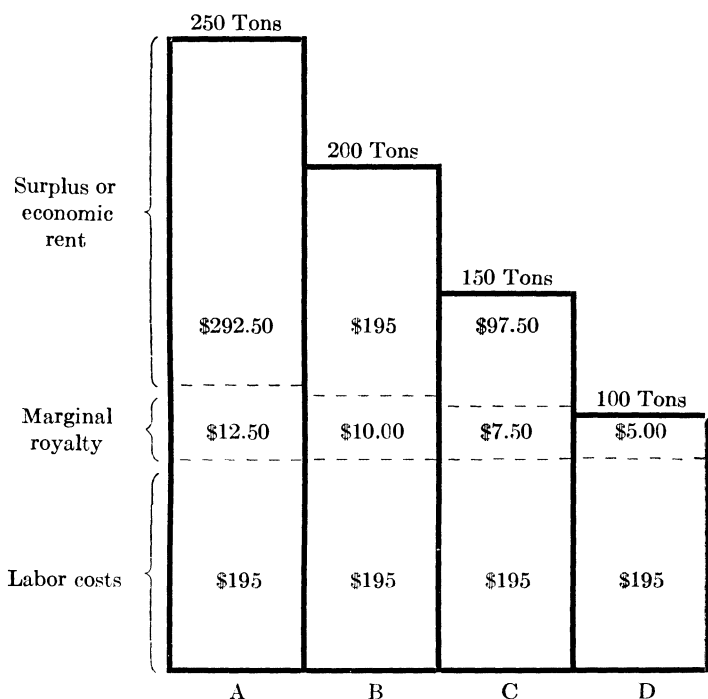


FIGURE 3

Four mines are represented, located in the same mining district and producing the same grade of coal. They differ only in depth of seams. All production costs are reduced to labor costs for the sake of clearness and it is assumed that an equal quantity of labor is employed in each mine — say ten units. From Mine A is obtained 250 tons of coal per week, from Mine B 200 tons, from Mine C 150 tons, and from Mine D 100 tons. Since the

quantity of labor employed in all four mines is the same the greater yield of the first three must be due to the greater ease of working the shallower seams. Coal is selling at the mine mouth at \$2.00 per ton. Thus the value of the weekly yield of Mine A is \$500, of Mine B \$400, of Mine C \$300, and of Mine D \$200.

The current wage of mine workers in the district is \$19.50 per week and each mine must pay out for its ten units of labor \$195. After wages are paid at Mine D, the poorest mine in the district, \$5.00 remains. It is not surplus. It is the amount that must be paid to the owner of the land for the coal removed. It is the marginal royalty and Mine D is the marginal mine. With a production of 100 tons the marginal royalty on each ton is 5 cents, the estimated marginal royalty at the present time for coal mines in the United States and Great Britain. Mine C yields 150 tons of coal per week with a value of \$300 at the mine mouth. One hundred and ninety-five dollars must be deducted for wages leaving a balance of \$105 from which must also be deducted the marginal royalty. The coal from Mine C is worth no more than the coal from Mine D when it reaches the surface and can command only the same marginal royalty — that is 5 cents per ton. More coal has been extracted during the week and the total marginal royalty on Mine C is \$7.50 instead of \$5.00. When this amount is subtracted from the balance of \$105, \$97.50 remains. It is a surplus arising because of the superiority of Mine C over Mine D. It is economic rent. Mines B and A have even greater advantages over Mine D and yield a larger surplus. Table V is an analysis of the value of the output for the four mines.

It is immaterial to the correctness of the theory of rent how the surplus is divided. If there is a surplus it must go to some one. Since the coal from all the mines

sells for the same price at the mine mouth and all mine labor in the district receives the same wage, neither consumer nor laborer can share in the surplus. It must go either to the owner of the land or to the operator of the mine. If the owner is fully awake to market conditions and to the superiority of his land he will secure the entire surplus; if he is not, the operator will receive a part. The fact that owner and operator may be one and the same person does not affect the existence of the surplus.

TABLE V

Mine	Tons raised per week	Value of product	Weekly wage	Marg. royalty		Surplus or economic rent	Economic rent per ton	Royalty that may be exacted per ton
				Per ton	Total			
D	100	\$200	\$195	\$.05	\$5.00	\$0.00	\$.00	\$.05
C	150	300	195	.05	7.50	97.50	.65	.70
B	200	400	195	.05	10.00	195.00	.975	1.025
A	250	500	195	.05	12.50	292.50	1.17	1.22

Since there remains, after wages are deducted, a surplus of \$305 from Mine A, or \$1.22 for every ton mined, the owner of the land may demand that amount as royalty. Five cents per ton is the marginal royalty, the remaining \$1.17 is economic rent. Mine B yields \$1.025 per ton royalty, of which 97½ cents is economic rent; Mine C yields 70 cents per ton of which 65 cents is economic rent; Mine D yields 5 cents per ton, all of which is marginal royalty.

With agricultural land there may be either an extensive margin, reached by adding successively poorer pieces of land, or an intensive margin, reached by adding increments or doses of capital or labor to the same piece. In the latter case economic rent arises as soon as the law of diminishing returns begins to act. With

mineral land an intensive margin may be reached providing the law of diminishing returns holds for mines. Professor Marshall is of the opinion that it does not, since the yield of mines is not "a net yield, like the return of which we speak in the law of diminishing returns, . . . but merely a giving up of their stored-up treasures."⁷ Most economists believe, however, that the law of diminishing returns applies to mineral land as well as to agricultural land tho some qualifications of the law may be necessary. The operator desirous of increasing his production has the choice of applying more labor and capital to the mine already being worked or of opening a second deposit less favored in its conditions. The working of rich and poor mines side by side would indicate that it is more profitable to apply capital in the poorer mines than to add it to the capital already applied in the richer mine. It is an evidence that the law of diminishing returns does apply to mines. The number of men who can work in a mine is limited by space if by nothing else and there is a similar limit to the amount of machinery that can be used. A hundred men might work a mine effectively but an increase of the number to a thousand would most certainly not increase the product tenfold. If the law of diminishing returns did not hold for mines operators could remove all the coal from a deposit in a short period of time rather than work it for 20, 50, or 100 years.

Figure 3 also shows economic rent arising from an intensive margin. Each block, instead of representing a mine as in the first illustration now represents the product from succeeding increments of capital applied to one mine. The first increment, dose A, yields 250 tons of coal per week, sufficient for a time to meet the demands of the market. There is no surplus and no eco-

7. Marshall, *Principles of Economics*, p. 166.

conomic rent. The situation is similar to that which would exist in a new country with an unlimited area of equally fertile agricultural land producing all that the market demanded. Farm land would command no rent. With increasing population more coal is demanded than can be produced by the first increment of capital. Prices rise until finally the operator of the mine adds another increment of capital to increase his production. If demand continues to increase he adds other increments. Because of diminishing returns dose B adds 50 tons less than the yield of dose A, or 200 tons, and doses C and D add but 150 and 100 tons respectively. The price of coal is \$2.00 per ton, an amount sufficient to make profitable the addition of dose D but not sufficient to warrant the addition of dose E. Dose D is the marginal dose and the preceding doses each yield a surplus. That surplus is economic rent. With the intensive margin, just as with the extensive margin of the first example, a marginal royalty must be deducted before the true economic rent can be determined. The marginal royalty is the balance remaining after all other production costs have been deducted from the yield of the marginal increment of capital.

III

What bearing does this analysis of mine royalties have on the question of nationalization of mineral lands? Who will receive the payments now going to the owners of the land if property in mineral deposits is taken over by the government? If the government does not confiscate minerals but buys them at a going value there will be nothing to divide, so long as conditions remain the same as at the time of purchase. The returns from the mines will go to pay the original owners or to pay interest on money borrowed to purchase the minerals.

Neither consumer nor laborer can benefit except through improved operation of the mines or more efficient distribution of the product under government control. True, conditions may not remain the same as at the time of purchase. The demand for coal may increase and make necessary the opening of inferior mines thus lowering the margin and increasing the economic rent. Any additional rent then received by the government might be divided according to the principles set forth in the next paragraph.

If the government should confiscate all property in minerals, a procedure inconceivable in either the United States or Great Britain, the distribution of the royalty will depend on which of the various courses open to the government is followed. The government may operate the mines itself; it may lease the mineral rights under competitive bidding to private operators; it may grant mining permits without any charge or for a nominal fee. If the first course, government operation of mines, is adopted, the government may either cover into the treasury the payments now made to land owners as royalties, or it may pass them along to the consumer through the decreased price of coal or to the laborer through increased wages, the surplus of the richer mines being used to offset the higher costs of production of the poorer mines. If the government leases the mineral rights in the open market to private operators, the only change in the present situation will be that the royalties will be paid to the government and not to a private land owner. Neither consumer nor laborer will benefit unless the revenue from the mines makes it possible to lower taxes.

The government may adopt the policy of free mining, that is the granting of mining permits to any applicant without charge or for only a nominal fee, a policy fol-

lowed in many European countries. The mine operator pays no royalties either to the government or to the owner of the surface. In favor of such an abolition of royalties it is argued that the price of coal to the consumer will thus be lowered. Yet if the entire amount of the royalty be passed along to the consumer, the saving would not be appreciable. The following is an analysis of the cost of a ton of Derbyshire coal laid down in the cellar of a London consumer: ⁸

	<i>s.</i>	<i>d.</i>
Royalties.....	0	4
Wages.....	13	5
Supplies and stores.....	3	6
Administration.....	0	5
Depreciation.....	0	4
Owner's profits.....	2	5
Coal controller's profits.....	0	9
Screening.....	2	3
Railway rate.....	6	3
Wagon hire.....	1	6
Factor's charge.....	0	4
Merchant's charge.....	12	6
	—	—
Total.....	44	0

Removal of the royalty would accomplish a saving of 4 pence on a selling price of 44 shillings — less than .8 of one per cent. Certainly the abolition of royalties does not promise any great benefits to the consumer. He must look elsewhere for means of reducing price. Such means are not hard to find. It should be noted in the above table that almost one-half of the cost of the coal is added after it leaves the mouth of the mine (cost at pithead 23s. 5d.). Material savings could be realized through the elimination of the 700,000,000 coal ton miles wasted in railway haulage because of cross hauls, through the pooling of the 700,000 colliery trucks now

8. British Coal Industries Commission Report (1919), vol. i, p. xii.

confined strictly to use of owner, and through the elimination of the wastes of wholesale and retail distribution.⁹ A saving of from 2 to 5 shillings per ton, and as high as 12 shillings per ton in some cases, has been brought about in England by the Coöperative Movement. It is in these ways, not through the abolition of royalties, that a substantial lowering of price to the consumer might be secured.

Small as the saving would be if the consumer should receive the entire amount of the royalty, he could not receive even this much. Figure 3 may be used to show just what the division of the royalty would be.

Mine D is the poorest mine that can be operated under existing market conditions. The only royalty paid on Mine D is the marginal royalty of 5 cents per ton and that amount would be the only saving to the operator of Mine D through the abolition of royalties. He can produce coal at \$1.95 per ton; but for a time he may continue to sell at \$2.00 per ton and pocket the saving.

Mines A, B, and C would benefit by the abolition of royalties to a greater extent than Mine D. The cost of production at Mine A would be 78 cents per ton, since the only cost of the 250 tons would be the labor charge of \$195. At Mine B the cost would be $97\frac{1}{2}$ cents per ton and at Mine C, \$1.30. The price of coal is governed, however, not by the cost of production at the most fertile mine but by the cost at the least fertile. All the coal mined would sell at the market price. The more fertile mines would continue to yield a surplus or economic rent. It would now go to the operator of the mine instead of to the former owner of the deposit. The consumer would receive only the saving realized at the marginal mine, or the marginal royalty of 5 cents per ton.

Because of the increased profits a fifth mine may

9. British Coal Industries Commission Report (1919), vol. i, p. xix.

finally open producing $97\frac{1}{2}$ tons of coal with 10 units of labor or at a per ton cost of \$2.00. The market would not demand the additional $97\frac{1}{2}$ tons at \$2.00 per ton and the price would have to fall. The new mine would be forced to close and a new market price would be established. Since the supply price is now somewhat lower than the former market price, more coal would probably be consumed. The new equilibrium would, therefore, be not at \$1.95—which is sufficient to bring to market only the former supply—but at some point between \$1.95 and \$2.00, say \$1.98 per ton. The consumer would receive not even the full amount of the marginal royalty. To recapitulate: *Only that part of the royalty which is compensation for the mineral taken from the land, or the marginal royalty, as I have called it, enters into price. The remainder, or the economic rent, does not affect price.*

It may be argued that with the abolition of royalties the richer mines, say Mine A of the example, operating at lower costs, may attempt to supply the entire market. Mine A can produce coal at 78 cents per ton and mines B, C, and D, unable to compete with such a low price, would be forced to close. Their production would be lost to the market and Mine A would have to increase production to meet the demand. The operation of poorer mines in the district would indicate that A is producing at the point of maximum efficiency. More intensive operation would bring into play the law of diminishing returns. The additional tons could be brought to market only at increasing costs. If the equilibrium between the four mines had been a stable one it would cost as much, or more, to produce in Mine A with intensive operation the last ton demanded by the market as it would cost with extensive operation in Mine D. As production costs in A mounted, Mines B, C, and finally D would reopen.

Labor has looked to the complete abolition of royalties as a means of increasing its wage. But the rent of mines has no more effect on wages than it does on prices. There is in every mining community a general level of wages. The worker in the fertile mine receives no more than the worker in the poor mine. Otherwise there would be a movement of workers from the poor mines to the fertile. The royalty takes nothing from the worker, since the poorest or marginal mine pays no royalty except the marginal royalty. This amount would probably reach the consumer through competition; but labor might succeed through a strong combination in stopping some of it. But the benefit would be small even if labor received all. The minimum royalty for coal in England has been estimated at from 2 pence to 3 pence per ton. At the latter estimate the amount to be divided among the 1,000,000 coal mine workers in Great Britain in 1918 would have been about \$15,300,000, or an increase of only some \$15.00 to the yearly wage of each. The amount that would go to the mine workers through the abolition of royalties was placed at about 1 shilling a week (about \$12.50 a year) by a witness before the Coal Industries Commission.¹

Labor has also favored the abolition of royalties on the ground that the better mines would then be able to supply a larger part of the production and force out the poorer mines. Wages would be increased because of the greater efficiency of the workers in the fertile mines. I have already pointed out that there would probably be little change in production; but even if the margin were raised the worker would suffer more than he benefited. If the better mines forced the marginal mines to close down, the laborers of the latter would be without em-

1. British Coal Industries Commission Report (1919), vol. ii, p. 439. Testimony of Mr. Harold Cox, Editor of *Edinburgh Review*.

ployment. In the resulting competition for the jobs in the mines still in operation, I should expect a decline in wages rather than an increase.

To conclude: after nationalization of mineral rights, if the government operates the mines, a part or all of the present royalties may be passed along to consumer or to laborer. If a middle course is followed, the government taking the place of the present land owners and leasing the mineral rights to private operators, neither the consumer nor the laborer can benefit directly. Indirectly they may benefit through lower taxes if the venture should prove sufficiently profitable to the government. If all royalties are abolished and free mining is permitted, the consumer and laborer can benefit only by the amount of the marginal royalty. The more fertile mines will continue to yield a surplus and that surplus will go to the operator.

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